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The differentiation of the colon is also described. After the return of the intestine from its extra-embryonic position, the cæcum, which marks the cephalic end of the colon, lies in the median plane. The cæcum then shifts to the left, and the part of the tube extending from it to the rectum stretches over the course of the descending colon. The growth of the tube in length now carries the cæcum transversely across the body cavity, thus laying out the course of the transverse colon. The tube at last extends caudally on the right side, bringing the cæcum to its adult position and establishing the ascending colon.

The coils of the small intestine were also carefully studied, but no common type of arrangement could be discovered even in embryos of the same litter and of the same size. As the small intestine, hardened in place in five adult cats, showed no common features so far as positions of coils were concerned, it may be assumed that there is no regularity in this respect in the cat.

The paper is concluded with an account of the changes in bulk and form shown by the liver and the probable influences which these have on the disposal of the viscera.

G. H. P.

Regeneration of Arthropod Appendages.¹—Readers of Bateson's "Materials for the Study of Variation" will recall the experiments made by him and Mr. Brindley on the peculiarities of the regenerated legs of the Blattidæ. Brindley has continued this work and gone over the literature of regeneration in arthropods, and concludes that the regenerated appendage follows one or the other of two types:

(1) In all respects, such as the number of joints and their relative dimensions, the reproduced appendage is the counterpart of the normal congenital appendage.

(2) The reproduced appendage differs from the normal appendage in certain respects which are constant, and in cases where maturity of the animal is attained through a series of ecdyses the special features of the reproduced appendage are perpetuated, so that, strictly speaking, the animal does not reproduce the normal appendage. The chief distinguishing feature of this kind of reproduction is that the number of joints present is *less* than in the normal appendage.

Morphology of the Protobranchia.—An interesting account of the habits, structure, and development of *Yoldia limatula*, *Nucula*

¹ Brindley, H. H. On Certain Characters of Reproduced Appendages in Arthropoda, Particularly in the Blattidæ, *Proc. Zool. Soc.*, London, for the year 1898.

delphinodonta, and *N. proxima*, from the coast of Maine, is given by Dr. G. A. Drew.¹ The mantle of *Yoldia* is supplied with two pairs of sense organs and a fringe of marginal tentacles. There is also an unpaired extensible siphonal tentacle which is protruded upon the surface of the mud in which the animal is buried. Development shows that this is homologous with the marginal tentacles. The foot of all the forms studied serves as a burrowing organ, not as a structure for creeping, as has often been supposed. The palps are active collectors of food, and the gills in *Yoldia* are very efficient pumping organs. The otocysts are provided with degenerating canals which lead toward the surface, and the genital ducts join the outer, not the inner, ends of the excretory organs. The eggs of *N. delphinodonta* are carried in cases of mucus-like material, while those of the other two species are cast free in the water. The embryos of the first-named species have no locomotor bands, and a feeble apical cluster of cilia, and their development is less rapid. The species of *Nucula* agree with *Yoldia*, which has been most fully studied,² in the formation of an ectodermal "test" which is afterwards cast off. From this primitive covering the definitive ectoderm, the nervous system, and the stomodæum are formed. The openings of the proctodæum and stomodæum are close together in the region of the primitive blastopore. At the time of metamorphosis the stomodæum, from its primitive opening to the position of the adult mouth, is cast off, together with a part of the apical plate. The test of these protobranchs is held to be the homologue of the velum of the molluscan larva, which has developed from ancestors resembling the embryos of *Yoldia* and *Nucula* in form and structure. *Chiton*, *Teredo*, *Cardium*, and *Polydordius* are known to cast away the velum of the larval stage. The test of the protobranchs is strikingly similar to that found by Pruvot on the embryo of *Dondersia* one of the primitive group of *Solenogastres*.

C. A. K.

Innervation of the Pharynx. — The innervation of the laryngeal muscles is an important point in settling their homologies with the muscles of the branchiate vertebrates. The usual statement is that the *recurrens* nerve supplies all the muscles except the *M. cricothy-*

¹ Drew, G. A. Some Observations on the Habits, Anatomy, and Embryology of Members of the Protobranchia, *Anat. Anz.*, Bd. xv, Nr. 24 (1899), pp. 493-519. With 21 figures.

² Drew, G. A. *Yoldia limatula*, *Mem. Biol. Lab. J. H. Univ.*, vol. iv, No. 3 (1899), 37 pp., 5 pls.